Travers

bushfire & ecology

Flora & Fauna Assessment

Planning Proposal
10 & 12 Boondah Road &
6 Jacksons Road
Warriewood

December 2016
(REF: A16179F)

Flora & Fauna Assessment

Planning Proposal
Lots 3 & 4 DP 26902 & Lot 9 DP 806132
10 & 12 Boondah Road & 6 Jacksons Road

DECEMBER 2016

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List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CLUMP	conservation land use management plan
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DoEE	Commonwealth Department of Environment & Energy
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act*
EPBC Act	*Environment Protection and Biodiversity Conservation Act*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act*
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for bushfire protection 2006*
POM	plan of management
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEARs	*Secretary's Environmental Assessment Requirements*
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Former Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (Superseded by DoEE)
SIS	species impact statement
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act*
VMP	vegetation management plan

Ecological Assessment

1.0 Background

Travers bushfire & ecology has been engaged to undertake survey and ecological assessment for a planning proposal, located at 6 Jacksons Road and 10-12 Boondah Road, Warriewood, within the local government area (LGA) of Northern Beaches Council (formerly Pittwater).

The three lots subject to the planning proposal are part of a broader study area from surveys undertaken by *Travers bushfire & ecology* in 2013, referred to at this time as the Warriewood Southern Buffer (see figure 2).

The current lots subject to the planning proposal include Lots 3 & 4 DP 26902 & Lot 9 DP 806132. The concept design footprint area within these lots and also incorporating the proposed APZ subject to direct impact on habitat will hereafter be referred to as the 'subject site' for assessment purposes. Figure 1 shows the study area with 2014 aerial photography.

Figure 1 – Aerial appraisal and study area

Figure 2 – Study area - Warriewood Southern Buffer

2.0 Planning Proposal

The planning proposal seeks to amend the Pittwater LEP 2014 for 10 & 12 Boondah Road, Warriewood to rezoning the subject site to E3 Environmental Management, B2 Local Centre and R3 Medium Density Residential to include a combination of commercial development and residential development.

Although 6 Jacksons Road forms part of the development site it will be reserved for recreation (boardwalk), flood storage and EEC conservation land. RE1 Public Recreation zoning is proposed.

The site forms part of the Southern Buffer Area in the Warriewood Valley Strategic Review Report. The proposed concept plan (refer Figure 3) has been developed in accordance with the required bushfire protection measures as stipulated from the bushfire assessment (*Travers bushfire & ecology,* 2016).

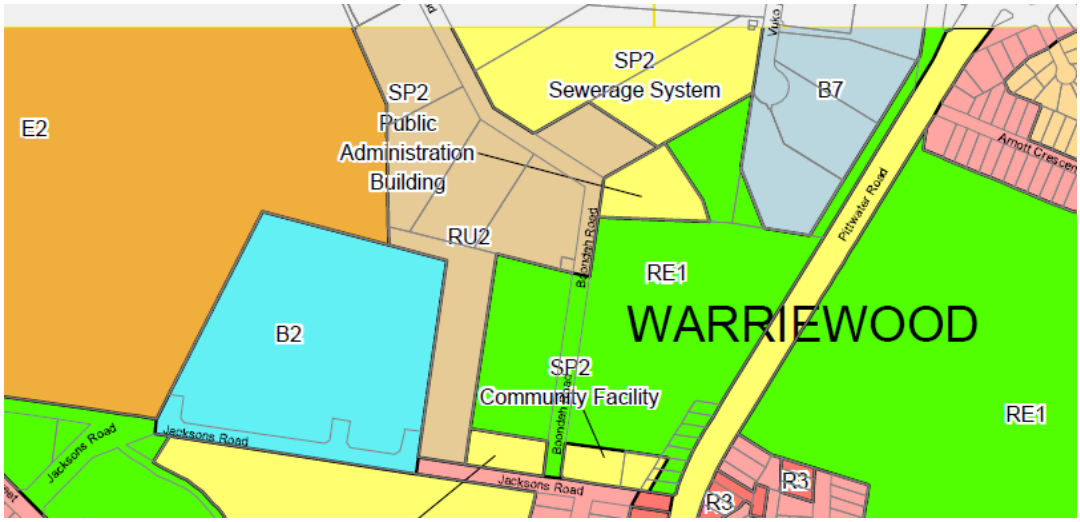

Figure 3a – Pittwater LEP 2014

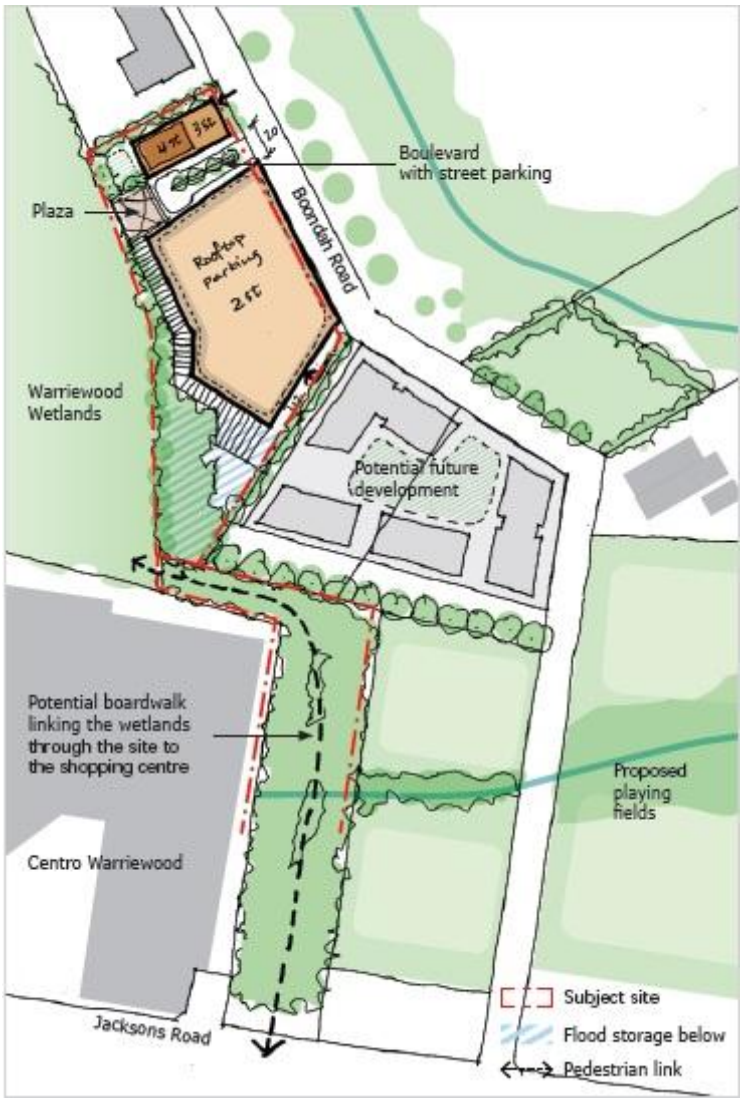

Figure 3b – Concept design

Site description

Table 1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1 – Site features

Location	10 and 12 Boondah Road, and 6 Jacksons Road, Warriewood
Size	Approximately 3.56 ha
Local government area	Northern Beaches (formerly Pittwater)
Grid reference	342250E 6270450N
Topography	The study area is almost flat with a slight rise from west to east
Geology and soils	Geology – Quaternary; alluvium, gravel, sand, silt and clay Soils – Warriewood Soil Landscape (deep sandy soils over quaternary sands with a high water table and localised flooding) and Disturbed Terrain
Catchment and drainage	A drainage line bisects 6 Jacksons Road which connects to wetlands immediately west of the study area.
Vegetation	Floodplain forests, wetlands and Bangalay forests
Existing land use	RU2 – Rural landscape. 6 Jacksons Road has no current residential development however.
Clearing	Approximately 75% of 10-12 Boondah Road has been previously cleared. Some parts of 6 Jacksons Road have been cleared or have been used as a shortcut to Warriewood Centro (shopping centre adjacent).

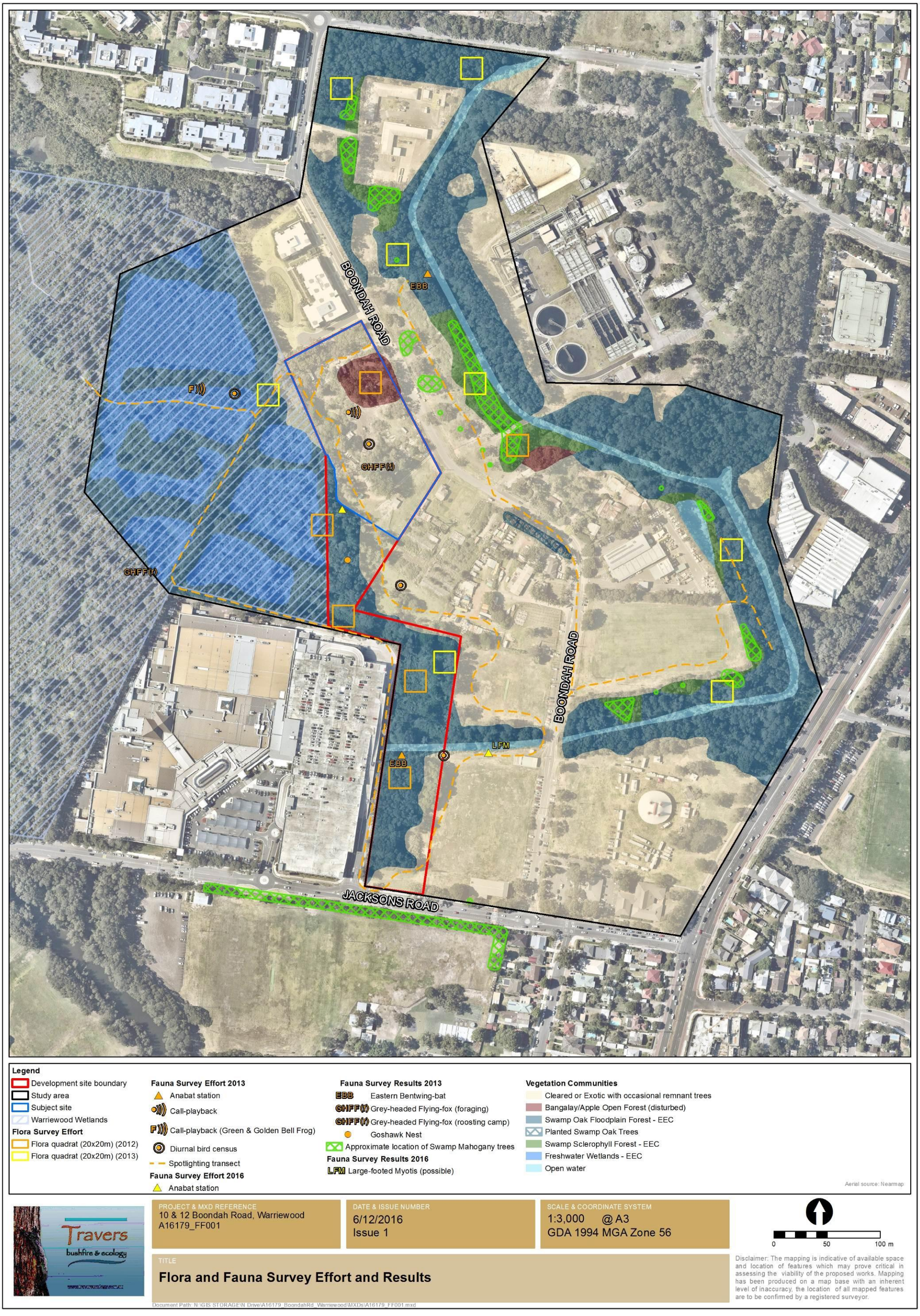

Figure 4 – Flora and fauna survey effort and results

4.0 Flora

4.1 Site assessment

An inspection of the subject site was undertaken on 15 May 2012 over approximately four (4) hours. Survey included ground-truthing of vegetation communities utilising aerial photography and 6x 20x20m floristic quadrats to determine vegetation types.

Survey on 13 April 2013 was undertaken over approximately five (5) hours and included 8x 20x20m quadrats and target searches for threatened flora species where applicable. This survey was extended outside of the properties described in Section 2 to incorporate the Southern Buffer and immediately beyond. Further site reconnaissance found that properties in the northern portion of the Southern Buffer contained two (2) endangered ecological community (EEC) vegetation types, Swamp Sclerophyll Forest on Coastal Floodplains as well as Swamp Oak Floodplain Forest. To the immediate north and west of *Centro* (shopping centre), the vegetation is largely the EEC Freshwater Wetlands with patches of Swamp Oak Floodplain Forest.

Note that field surveys were conducted over a larger area than the planning proposal area.

Updated constraints mapping was undertaken in February 2015 as well as a response to the Joint Regional Planning Panel.

An updated review of the Atlas of NSW Wildlife (OEH 2016) and EPBC protected matters tool was undertaken in December 2016 to identify if there are additional threatened species issues to address as part of the planning proposal. Both databases were examined for threatened species or habitats out to a 10km radius.

4.2 Vegetation communities

Three (3) vegetation communities were recorded on site:

- Swamp Oak Floodplain Forest
- Bangalay / Apple Open Forest
- Cleared or Exotic with Occasional Remnant Trees

<u>Swamp Oak Floodplain Forest</u>

Canopy:

Canopy consists of Swamp Oak (*Casuarina glauca*) to a height of 15-22m and a projected foliage cover of 40-75%. Occasional weed species such as Coral Tree (*Erythrina sykesii*) were observed.

Mid-storey:

The mid-storey is largely devoid of native vegetation, however, occasional small trees, palms and shrubs were present such as *Melaleuca linariifolia, Melaleuca ericifolia, Glochidion ferdinandi* and *Livistona australis* up to 10% projected foliage cover. The mid-storey contains a large portion of invasive weeds such as Lantana, Senna, Camphor Laurel, Morning Glory and Japanese Honeysuckle at several sites either within the current study area or on adjoining properties which formed the Warriewood Southern Buffer.

Ground layer:

The ground layer contains a number of sedges, herbs and ferns that varied in coverage considerably between the quadrats.

Common ground cover species include *Phragmites australis, Juncus* spp., *Gahnia sieberiana, Parsonsia straminea, Hypolepis muelleri, Centella asiatica, Carex appressa, Commelina cyanea, Centella asiatica, Blechnum cartilagineum* and *Viola hederacea.*

Significance:

This vegetation community is an endangered ecological community (EEC) by the same name.

Photo 1 – Swamp Oak vegetation near the southern edge of the current study area

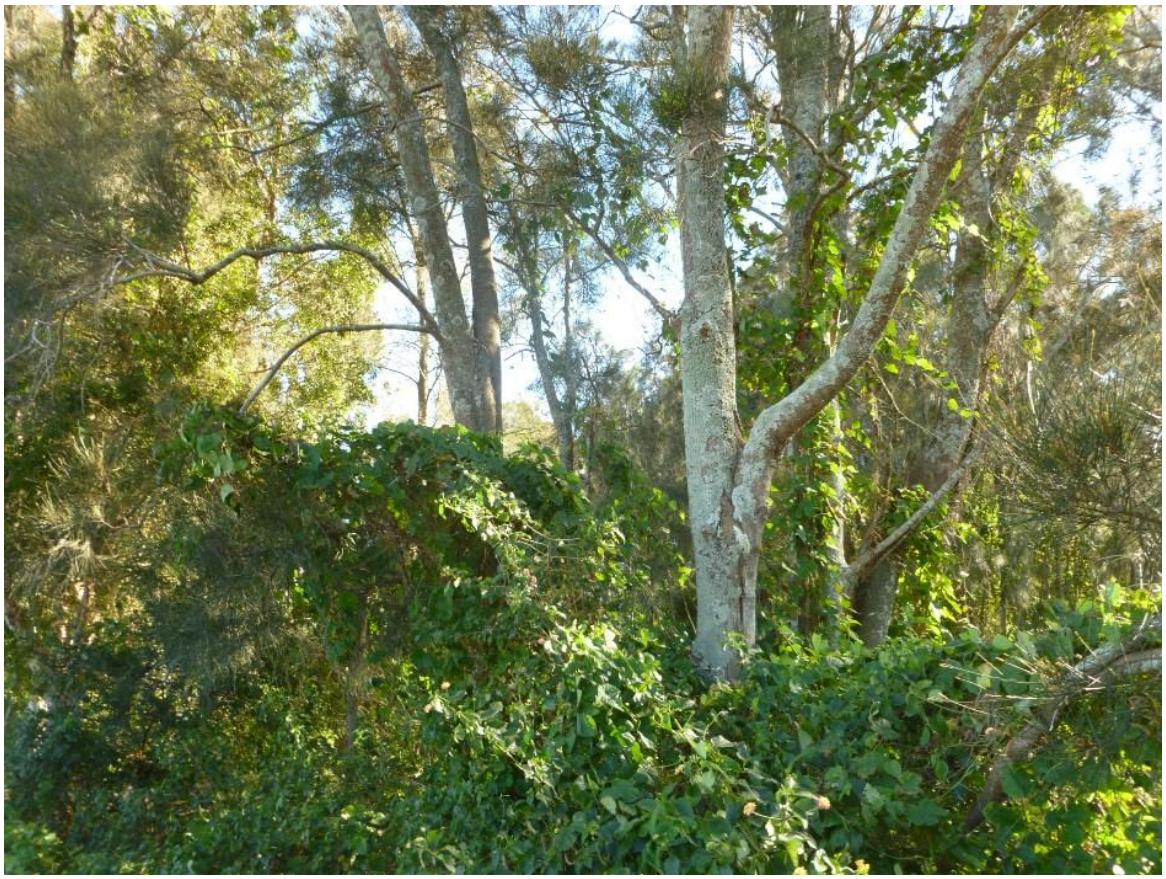

Photo 2 – Swamp Oak vegetation in 6 Jacksons Road just a few metres from Centro car park

Bangalay / Apple Open Forest (disturbed)

Canopy:

Within the current study area, a few Smooth-barked Apples (*Angophora costata*) coexist amongst the Bangalays (*Eucalyptus botryoides*). A few Bangalays overhang the boundary on the eastern side of Boondah Road. The projected foliage cover of the canopy is approximately 25-35% and the height of the trees is between 15-20m.

Mid-storey:

It should be noted that the majority of the native mid-storey is absent and replaced by weed species such as Green Cestrum, Lantana and Senna.

Ground layer:

The ground layer contains very limited native species. No native mid or ground layer species were noted in the quadrat undertaken in this vegetation type on the Cassius property.

Significance:

This vegetation community is not considered to be part of an EEC. It may have once been equivalent to the EEC Bangalay Sand Forest, however the remnant is too small and lacks native understorey vegetation. It does not continue across to the other side of Boondah Road so no further areas to investigate. Both main canopy species may also occur in Coastal Sandstone Gully Forest. The extent of this community within the development site boundary is 0.21 ha. This is proposed for full removal.

Photo 3 – Disturbed Bangalay / Apple Forest near northern portion of the current study area

Cleared or Exotic with Occasional Remnant Trees

As the name suggests, a large portion of the development site is cleared as there was or has been previous dwellings and improvements, including the planting of trees or gardens. There are a number of Cocos Palms on site (see Photo 4), with overgrown gardens beds, some deciduous trees and the occasional remnant tree which is mostly a Bangalay or outlier Swamp Oak.

Photo 4 – Viewing part of no. 10 and 12 Boondah Road on the eastern side

Photo 5 – Cleared vegetation with exotic regrowth near the northern edge of the subject site

4.2.1 Nearby freshwater wetlands

The sensitive vegetation is part of the EEC Freshwater Wetlands on Coastal Floodplains and contains a number of unique species that are considered rare or endemic to northern Sydney. No quadrats or other stratified survey have been undertaken within this vegetation community by this firm. Some species observed by random meander are however listed in Appendix 1. Some common species observed include *Melaleuca ericifolia, Persicaria* spp., *Azolla pinnata, Schoenoplectus* sp., *Eleocharis sphacelata, Casuarina glauca, Juncus* spp., and *Phragmites australis.*

Photo 6 – Wetlands approximately 100m north of Warriewood Centre

4.3 Threatened flora species

Threatened Species Conservation Act (TSC Act) – A search of the *Atlas of NSW Wildlife* (OEH, 2016) provided a list of threatened flora species previously recorded within a 10km radius of the subject site. These species are listed in Attachment 3 (Table A3.1) and are considered for potential habitat within the subject site.

Environmental Protection and Biodiversity Conservation Act (EPBC Act) – A review of the schedules of the *EPBC Act* identified a list of threatened flora species or species habitat likely to occur within a 10km radius of the subject site.

In accordance with Table A3.1, the following threatened flora species are considered to have potential habitat within the subject site.

Table 2 – Threatened flora species with suitable habitat present

Scientific Name	TSC Act	EPBC Act	Potential to occur
Acacia bynoeana	E1	V	Limited potential habitat but not expected to occur. All 4 records within 10km are 15 years or older
Caladenia tessellata	E1	V	Limited potential habitat but not expected to occur
Callistemon linearifolius	V	-	Low possibility
Cryptostylis hunteriana	V	V	Limited potential habitat but not expected to occur Only 1 record within 10km and from 1954 with a 10km accuracy
Deyeuxia appressa	E1	E	Limited potential habitat but not expected to occur given no records in the Sydney area since 1941
Melaleuca biconvexa	V	V	Potential habitat is present, but low likelihood as there are no records within 10km

Callistemon linearifolius has been recorded nearby to the Warriewood Wetlands. The surrounding habitat may provide some form of potential habitat.

Melaleuca biconvexa occurs in swamp locations nearby creeks in alluvial soils near the coast. The site provides potential habitat, however, given that there are no recordings of the species within a 10km radius, the likelihood of occurrence is considered low.

Botanical survey of the broader study area has not identified any threatened flora species.

As there are no EPBC listed species on site, no additional assessments or referrals to DoEE are required.

4.4 Endangered flora populations

No endangered flora populations occur within a 10km radius of the study area, and there are none currently linked to Northern Beaches LGA or the former Pittwater LGA.

4.5 Endangered ecological communities

The EEC - Swamp Oak Floodplain Forest is an endangered ecological community, is also listed as an endangered wetland community and typically would have a high priority for conservation. It occurs along the western edge of no. 10, the southern tip of no. 12 Boondah Road, and is extensive through no. 6 Jacksons Road which is proposed for conservation.

The total amount of Swamp Oak Floodplain Forest within the development site boundary area is nil thus the planning proposal will not segment the EEC into fragments nor place it in isolation.

The local extent of Swamp Oak Floodplain Forest EEC is extensive along Narrabeen Creek which passes through no. 6 Jacksons Road, and heads towards Narrabeen Lake. It also connects to other extensive areas of vegetation within Warriewood Wetlands which contains a mixture of Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest on Coastal Floodplains and Freshwater Wetlands. There will be no loss of this community due to the proposed development.

Considering these areas of Swamp Oak Floodplain Forest are sited adjacent to large retail development, residential development and other commercial type practices and have survived, this planning proposal is unlikely to cause their local extinction. The planning proposal will however contribute to indirect impacts, particularly those that may encourage further weed growth and alterations to local hydrology. These impacts are very important because of the freshwater wetland which is sited only a few metres from the western boundary of the development site boundary.

We note that the indirect impacts can be managed as part of the conditions of consent and can be well mitigated through appropriate management of the adjoining vegetation to no. 10 and 12 Boondah Road, and vegetation on no. 6 Jacksons Road (such as a vegetation management plan to be monitored by a project ecologist). Even despite these considerations for management, the indirect of the impacts planning proposal are unlikely to place the EEC at risk of local extinction.

4.6 Endangered wetland communities

A number of wetland communities that have been listed as an 'endangered ecological community' under the NSW TSC Act. Those wetland communities must given due consideration in accordance with the NSW Wetlands Policy (2010).

- Artesian springs ecological community - endangered ecological community listing
- Castlereagh swamp woodland community - endangered ecological community listing
- Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing
- **Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing**
- Kurri sand swamp woodland in the Sydney Basin Bioregion - endangered ecological community listing
- Lagunaria swamp forest on Lord Howe Island - endangered ecological community listing
- Maroota Sands swamp forest - endangered ecological community listing
- Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions - endangered ecological community listing
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion - endangered ecological community listing
- **Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing**
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological listing
- Sydney Freshwater Wetlands in the Sydney Basin Bioregion - endangered ecological community listing.

- The shorebird community occurring on the relict tidal delta sands at Taren Point - endangered ecological community listing
- Upland wetlands of the drainage divide of the New England Tableland Bioregion - endangered ecological community listing.

The following communities observed onsite are recognised as an Endangered Wetland Community:

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing

Subject to offset provisions, a riparian buffer applies to these communities under the NSW DPI - Office of Water - Guidelines for Controlled Activities. Where the wetland vegetation is cleared, highly fragmented or highly disturbed, consolidation and management in accordance with a Vegetation Management Plan is recommended. The buffers provided are to be considered in an integrated landscape context and consultation with NSW DPI – NSW Office of Water undertaken to confirm the appropriateness of setbacks.

Intended development works will have a minimum 10 metre wide buffer around the extent of endangered ecological communities due to the presence of a managed APZ. A minimum 15m buffer will be applied to Warriewood wetlands. It is recommended that a vegetation management plan (VMP) be prepared to specify the strategies and works required to manage this vegetation community within the study area. Revegetation works within the APZ is to include native species endemic to the surrounding native vegetation communities. Plantings are to focus on key foraging species to assist in maintain an enriched foraging landscape in a managed ecological/APZ zone.

4.7 Groundwater dependent ecosystems (GDEs)

Groundwater dependent ecosystems are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal;
- sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.

The State Groundwater Dependent Ecosystems Policy is specifically designed to protect our valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of their dependent ecosystems are maintained or restored, for the benefit of present and future generations.

The adjoining Warriewood Wetlands and endangered wetland communities as listed above are present and are typically considered to be Groundwater Dependent Ecosystems. Consequently the impact on groundwater dependent ecosystems needs to be considered as part of a development application.

Both EECs within the study area are also groundwater dependent ecosystems (GDE's). The State Groundwater Dependent Ecosystems Policy is specifically designed to protect our

valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of their dependent ecosystems are maintained or restored, for the benefit of present and future generations. The principles of this policy need to be duly considered as part of the proposal.

Principle One
Groundwater-dependent ecosystems can have important values for groundwater users, ecosystem managers, scientists and the wider community and for the protection of our biodiversity and cultural heritage. These values, and how threats to them may be avoided, should be identified and action taken to ensure that the ecosystems are protected.

Principle Two
Groundwater extractions should be managed within the sustainable yield of aquifer systems, so that the ecological processes and biodiversity of their dependent ecosystems are maintained and/or restored. This will involve consideration of threshold levels that are critical for ecosystem health.

Principle Three
Priority should be given to ensuring that sufficient groundwater of suitable quality is available at the times when it is needed:

- for protecting ecosystems which are known to be, or are most likely to be, groundwater dependent; and,
- for ecosystems where there is an immediate or high degree of threat.

Principle Four
Where scientific knowledge is lacking, the precautionary principle should be applied to protect groundwater dependent ecosystems. The development of adaptive management systems and research to improve understanding of these ecosystems is essential to their management.

Principle Five
Planning, approval and management of developments and land use activities should aim to minimise adverse impacts on groundwater systems by:

- maintaining natural patterns of recharge and minimising disruption to groundwater levels that are critical for ecosystems;
- not polluting or causing changes in groundwater quality; and
- rehabilitating degraded groundwater systems where possible.

The GDE's within the planning proposal area will be retained and will not be adversely affected by the proposed works due to the local flooding patterns and existing drainage which will be maintained.

Intended development works will have a 10 metre wide buffer around the extent of GDE's due to the presence of a managed APZ. It is recommended that a vegetation management plan (VMP) be prepared to specify the strategies and works required to manage this vegetation community within the study area. Revegetation works within the APZ is to include native species endemic to the surrounding native vegetation communities,. Plantings are to focus on key foraging species to assist in maintain a enriched foraging landscape in a managed ecological/APZ zone.

5.0 Fauna

5.1 Survey

Fauna field survey was undertaken on the 8 & 9 April 2013 included:

- *Four (4) diurnal bird census points* undertaken along the western interface within natural habitats. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 20-40m. Bird census points were selected to give an even spread and representation along the fringes of high quality habitat within the Warriewood Wetlands. Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

- *Nocturnal call-playback* for threatened species with suitable habitat present and / or nearby records, including Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*), Bush Stone-curlew (*Burhinus grallarius*), Koala (Phascolarctos cinereus) and Green and Golden Bell Frog (Litoria aurea).

- *Nocturnal spotlighting* along forest / woodland edges and within the nearby Warriewood wetland area.

- *Passive Anabat monitoring (x3)* which involves leaving a bat recorder in a fixed mounted position to record call sequences of passing bats for the first few hours after dusk. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. The Large-footed Myotis was targeted by recording along the Narrabeen Creek including one recorder near to existing culverts where this species is known to roost. One *Anabat* recorder placed along the swamp forest edge did not record due to a faulty flash card and is not included in the effort.

- *Identification of significant habitat trees*. These are defined as trees containing large hollows suitable for use by owls / cockatoos or containing a number of good quality hollows typically consisting of more than one (1) medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found, such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

- *Threatened fauna species habitat assessment* with consideration of threatened fauna species previously recorded within 10km of the subject site area on the *Atlas of NSW Wildlife* (OEH 2013) and species listed as having potential habitat within 10km as considered by the *EPBC Protected Matters Search Tool* (SEWPAC 2013).

Updated fauna survey was undertaken on the 6th December 2016 which included:

- *Detailed habitat tree survey of the subject site area*.
- *Passive overnight Ultrasonic microbat monitoring (x2)*
- *Opportunistic bird survey*

The full survey effort table showing timing and weather conditions is provided in Attachment 1. Specific survey effort locations and results are shown on Figure 4. All fauna species recorded during survey within the subject site and nearby surrounds are listed in Table A2.2 in Attachment 2.

A review of the Atlas of NSW Wildlife (OEH 2016) was undertaken prior to the recent site visit to determine threatened species previously recorded within 10km of the subject site.

5.2 Hollow-bearing trees

A search for significant habitat trees within the study area was undertaken during 2013 survey. No significant habitat trees were identified within the study area or are likely nearby. These include trees containing large hollows suitable for nesting by owls / cockatoos or containing a number of high quality medium or small hollows. The lack of hollows is attributed to historical land clearance within previously eucalypt forested areas and the lack of hollows within the remaining Swamp Oak forest areas.

One (1) tree was identified at this time as containing a raptor nest located in the south western corner of the subject site. A photo of this nest was sent to birding expert John Young for identification who concluded it most likely belongs to a non-threatened goshawk species. Therefore this nest is not likely to belong to any threatened or protected migratory bird species.

A detailed search for all hollow-bearing trees within the subject site area was undertaken as part of updated 2016 surveys. No hollows were recorded within the subject site and therefore no denning/roosting/breeding habitat of hollow-dependent threatened fauna species will be likely impacted by the proposal.

Nonetheless, the proposal may supplement loss of hollows with relocated hollows and nest boxes within the remaining trees along the western edge of the subject lots in order to support greater denning/roosting/breeding habitat opportunity adjacent to the wetland area. Nest boxes for possums, parrots and cockatoos may also supplement prey species habitat for the locally recorded Barking Owl and Powerful Owl.

5.3 Threatened & protected fauna species

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2016) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Attachment 3 (Table A3.2) and are considered for potential habitat within the subject site. Strictly coastal, estuarine and oceanic threatened species found within 10km have not been included as there is no coastal interface or marine related habitat present within the study area.

Two (2) state listed threatened fauna species including Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were recorded present during 2013 surveys. One (1) additional threatened fauna species the Large-footed Myotis (*Myotis macropus*) was recorded only to a 'possible' level of certainty during updated 2016 survey. Other threatened fauna species have been recorded in the nearby locality and in recent years, such as Barking Owl, Black Bittern, Australian Painted Snipe, Little Eagle, Osprey, Powerful Owl, Varied Sittella, East-coast Freetail Bat and Little Bentwing-bat that potentially use the study area on a seasonal or periodic basis.

Some species recorded nearby during recent years are strictly wetland dependent species (such as Black Bittern, Australian Painted Snipe and also Australasian Bittern) that are not likely to have any utilisation or dependence on the subject site itself. Indirect impacts on these species such as lighting and noise spill-over into the wetland areas to the west have been considered.

The 7 part test (Attachment 4) has concluded that there is unlikely to be a significant impact on any state listed threatened fauna species as a result of the proposal by the proposal.

Therefore, a Species Impact Statement should not be required in respect to threatened fauna species.

State Environmental Planning Policy No. 44 (SEPP 44) - Koala Habitat Protection – The subject site is required to be considered under SEPP 44 as it falls within the old Pittwater LGA, which is listed on Schedule 1 of this Policy.

Two Koala food tree species – Swamp Mahogany (*Eucalyptus robusta* and Tallowwood (*Eucalyptus microcorys*), as listed on Schedule 2 of SEPP 44, were recorded within the study area. Tallowwood occurs as planted specimens in a patch of approximately ten (10) individual trees within the Cleared or Exotic with Occasional Remnant Trees vegetation community. Although such non-endemic mature planted trees may be available for use by Koalas in locations where Koala populations occur, SEPP only applies to "areas of native vegetation" in consideration to PKH and therefore these trees are not considered here in determining PKH.

Swamp Mahogany trees occur naturally in the study area as a number of mature individuals on the eastern side of Boondah Road. These trees comprised greater than 15% of the total number of trees within the Swamp Sclerophyll Forest community and combined with additional trees immediately adjacent within the Cleared or Exotic with Occasional Remnant Trees Community. Figure 4 shows the location of Swamp Mahogany trees identified during 2013 surveys in the study area. No Swamp Mahogany trees are present within the three lots making up the current development proposal on the western side of Boondah Road, therefore the site is not classified under SEPP 44 as PKH and no further assessment under this policy is required.

The proposal will not affect existing connective access to the available Koala feed trees on the eastern side of Boondah Road. No Koalas were directly observed at the time of fauna surveys, which included diurnal searches of trees, call-playback techniques and spotlighting.

Potential presence based on local records and remaining local habitat connectivity is discussed below in Section 5.4 given that any remaining local Koalas are part of the endangered Koala population in the Pittwater LGA. Based on these considerations, the study area is also not likely to form CKH under the definitions of SEPP 44.

Fisheries Management Act (FM Act) – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Attachment 3 (Table A3.2). One (1) nationally listed threatened fauna species the Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded present during surveys. Based on a review of the EPBC significant impact criteria, no threatened species listed under this act are likely to be significantly impacted by the proposal.

Protected migratory species listed under the *EPBC Act* are considered for habitat potential in Table A3.3. No protected migratory bird species were recorded during survey or are considered likely to be significantly impacted by the proposal.

In accordance with Table A3.2 the following state and nationally listed threatened fauna species are considered to have potential habitat within the subject site. The TSC Act listed species are to be considered for impact assessment in a seven-part test of significance (Attachment 4).

Table 3 – Threatened fauna species with suitable habitat present

Common name	TSC Act	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	V	recorded
Eastern Bentwing-bat	V	-	recorded
Large-footed Myotis	V	-	Recorded (possible)
Black Bittern	V	-	✓
Little Eagle	V	-	✓
Square-tailed Kite	V	-	✓
Osprey	V	-	✓
Little Lorikeet	V	-	✓
Swift Parrot	E	E	✓
Barking Owl	V	-	✓
Powerful Owl	V	-	✓
Varied Sittella	V	-	✓
East-coast Freetail Bat	V	-	✓
Large-eared Pied Bat	V	V	✓
Little Bentwing-bat	V	-	✓
Australasian Bittern	E	E	low
Bush Stone-curlew	E	-	low
Regent Honeyeater	E4A	E	low
Greater Broad-nosed Bat	V	-	low
Green and Golden Bell Frog	E	V	unlikely
Australian Painted Snipe	V	V	unlikely
Gang-gang Cockatoo	V	-	unlikely
Masked Owl	V	-	unlikely
Dusky Woodswallow	V	-	unlikely
Scarlet Robin	V	-	unlikely
Spotted-tailed Quoll	V	E	unlikely
Koala	V	V	unlikely

The potential habitat for protected migratory species listed under the *EPBC Act* is considered in Table A3.3. Based on a review of the EPBC significant impact criteria, no protected migratory species are likely to be significantly impacted by the proposal.

5.4 Endangered fauna populations

Two (2) endangered fauna populations are recorded within 10km of the study area. These include the Koala population in the Pittwater LGA and the Squirrel Glider population on Barrenjoey Peninsula.

The Squirrel Glider population is identified north of Bushrangers Hill which is located more than 3km to the north of the study area. There are no records of Squirrel Glider within this distance and therefore the study area is not considered to contribute any habitat of importance to this population.

Koalas forming part of the endangered population have been previously recorded in the locality surrounding the study area. These records are mostly prior to 1950 with the most recent nearby record located north of the study area in 1975. All of these nearby Koala records are to a 1km accuracy, suggesting they were estimated / approximate locations of historical sightings. The study area contains a mature stand of Swamp Mahogany trees located between Boondah Road and Narrabeen Creek, as well as along the fringes of the Warriewood Wetlands.

There is no doubt that the Swamp Mahogany trees present within the study area would have formed important habitat for the local Koala population when this population was previously well represented in the nearby locality. Habitat removal, fragmentation and isolation in the Pittwater LGA over the last hundred years or so has put high pressures on this population which has diminished to what now appears a non-viable population. Stressed Koalas competing with urban landscapes are more susceptible to disease and poor population dynamics.

Based on records alone, it is unlikely that any remaining Koalas that cling onto remaining habitats in the Pittwater LGA still utilise the available habitat present within the study area. Locations of Swamp Mahogany observed during the flora survey within and near to the study area are shown on Figure 4. This tree is not only an important Koala feed tree but is a profuse winter flowering resource to nectar dependent fauna, including the endangered migratory Swift Parrot which has also been recorded in the locality. No Swamp Mahogany trees are present within the three lots making up the current development proposal on the western side of Boondah Road. These Swamp Mahogany trees will also be continually available to free ranging local Koalas which have an 'unlikely' potential to occur.

5.5 Vegetation connectivity and wildlife corridors

The development site boundary is shown on figure 5 in orange, with the local habitat connectivity shown in yellow. Connectivity is fragmented in places where roads bisect the free passage for terrestrial species or where the linkages narrow due to fragmentation.

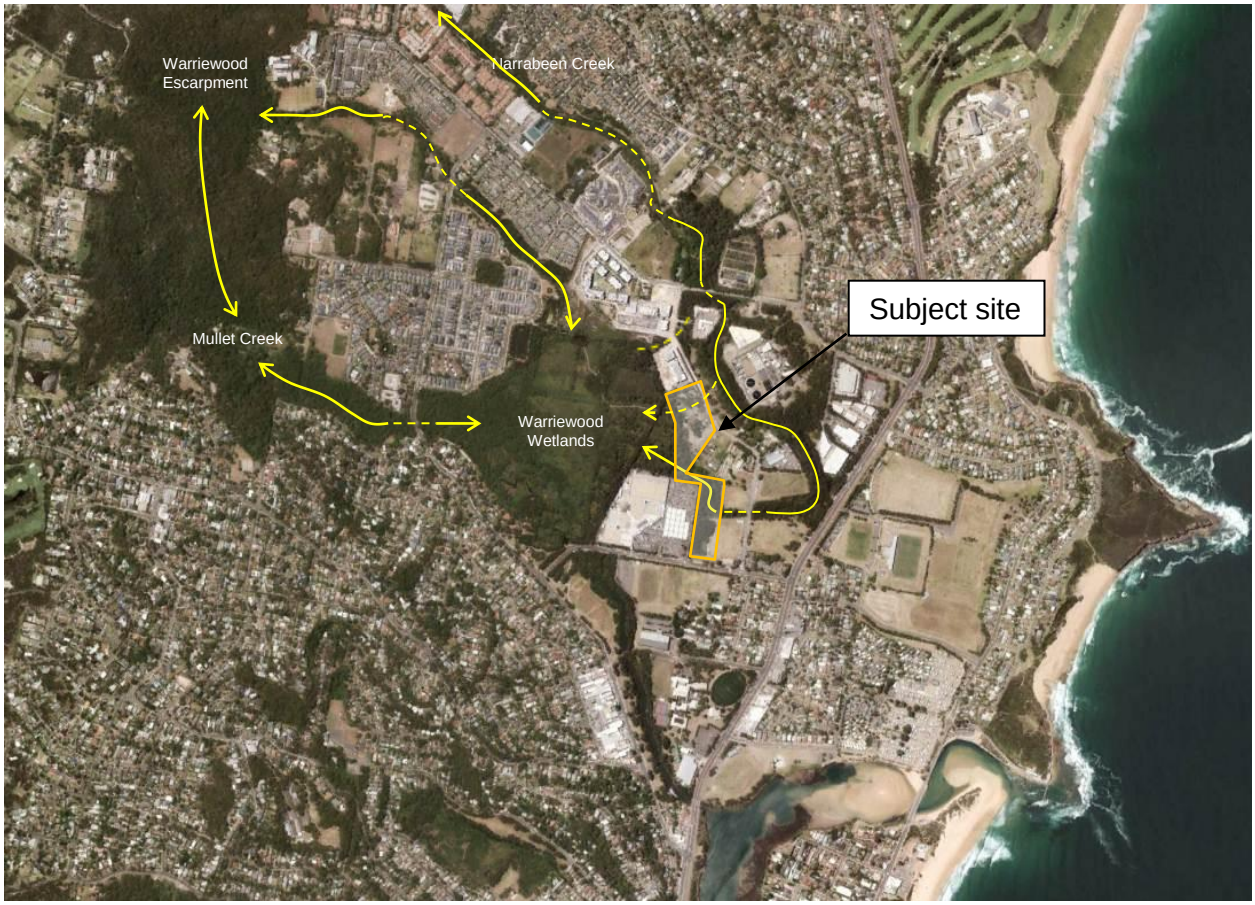

Figure 5 – Local connectivity

The subject site contributes to local connectivity in two ways but neither of these are of local significance or sufficient to contribute to local or regional 'corridors'. This is particularly given

that the creekline connectivity that does extend to the east does not link up with any other major area of natural habitat, but rather loops around to return to the same connective forest areas surrounding Warriewood Wetlands and the Warriewood Escarpment.

The planning proposal seeks to retain all native vegetation forming the connectivity link along the western boundary and crossing Boondah Road to the south (which is the preferred outcome of the proposed layout). The second and more direct passage across the northern portions of the site is currently limited to only fragmented canopy trees for birds and common arboreal mammals. This fragmented secondary connectivity will be removed as a result of the planning proposal.

The only threatened species records that exist along the Narrabeen Creek connectivity to the east are highly mobile flying species (incl. Grey-headed Flying-fox, Powerful Owl, Barking Owl and Little Bentwing-bat). The removal of the fragmented cross-site connectivity is not likely to affect important habitat or local movements of any of these species recorded further east.

Improvements by restoration and widening of the first mentioned connectivity to the south along Narrabeen Creek would provide the better option to enhance existing local connective opportunities for both arboreal and terrestrial species. This may however be limited by the required size of playing fields.

6.0 Conclusions

No threatened flora species or endangered populations occur within the development site boundary. The EECs Swamp Oak Floodplain Forest and Freshwater Wetlands on Coastal Floodplains have been recorded within the development site boundary or immediately adjacent. The proposed buildings and APZs have been sited such that they will avoid a direct impact upon either EEC, with APZ setbacks generally from the EEC edge. There may be a very small linear impact if there is a boardwalk or path constructed that provides a short cut to Warriewood Centro shopping centre, however it would likely not require any removal of trees or mid-storey.

The proposal may have incremental and cumulative impacts upon adjoining wetland vegetation types, however the retained vegetation and required asset protection zones will provide sufficient buffering to mitigate any indirect impacts. The proposal has been sited to limit direct and indirect impacts, and the indirect impacts may be mitigated and controlled as part of the conditions of consent These mitigation measures will limit access to remnant bushland and consequential trampling and dumping, sediment and erosion control, weed control, revegetation works and the construction of nutrient ponds / detention basins / bioswales, etc.

In respect to threatened fauna species, the subject site provides recorded foraging habitat for Grey-headed Flying-fox, Eastern Bentwing-bat and a possibly recording of Large-footed Myotis, as well as potential foraging by other species.

The other threatened fauna species which have a high potential to frequent the site seasonally, or on occasion, include the Powerful Owl, Barking Owl, Little Eagle, Varied Sittella, Little Lorikeet, Swift Parrot, East-coast Freetail Bat and Little Bentwing-bat. The existing culverts at the intersection of Narrabeen Creek and Boondah Road may have breeding / roosting potential for Large-footed Myotis and roosting potential for the Eastern Bentwing-bat and Little Bentwing-bat.

Foraging habitat removed as part of the proposal is not considered unique or of local significance to threatened species that persist in the otherwise highly developed locality.

The subject site is not likely to provide any breeding habitat or habitat otherwise of importance to threatened fauna species recorded or with varying potential to occur. No hollow-bearing trees or other unique or potentially important habitat features will be removed by the proposal. The removal of habitats present within the subject site is therefore not likely critical to life-cycle requirements of these species, or likely to significantly disturb behaviour.

The habitat to be removed does contribute to cross-site arboreal connectivity however this is not considered of any local significance. Other remaining connectivity further south along Narrabeen Creek will remain and is recommended for restoration.

The current concept layout follows previous advice to:

- Avoid impacting on lots containing the important winter flowering Swamp Mahogany which may play an important function for providing unique foraging resources in the locality, particularly for the endangered Swift Parrot;
- Retain, and where appropriate restore, riparian habitat along Narrabeen Creek that ensures habitat connectivity is maintained in the locality; andw
- Ensure that any proposal does not impact directly or indirectly on the high quality habitat available in the adjacent Warriewood Wetlands to the west.

Given consideration to planning proposal footprint, indirect impacts, the available adjacent habitats present, local records and species with potential to occur, the 7 part test of significance (Attachment 4) has concluded a not significant conclusion with respect to the potential impact upon threatened species, communities and populations. Therefore, a Species Impact Statement should not be required for the development.

The Significant Impact Criteria for species listed under the *EPBC Act* was reviewed to assess the impacts of the proposal on nationally listed species. It is concluded that there will not be a likely significant impact on any nationally listed threatened species and as such, a referral to the Commonwealth Department of Environment (DOE) is not required.

6.1 Suitability of proposed zonings

Zone B2 Local Centre

1 Objectives of zone

- To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area.
- To encourage employment opportunities in accessible locations.
- To maximise public transport patronage and encourage walking and cycling.
- To provide healthy, attractive, vibrant and safe local centres.
- To strengthen the role of centres as places of employment.
- To provide an active day and evening economy.
- To provide for residential uses above street level where they are compatible with the characteristics and uses of the site and its surroundings.

2 Permitted without consent

Home businesses; Home occupations

3 Permitted with consent

Amusement centres; Boarding houses; Car parks; Child care centres; Commercial premises; Community facilities; Educational establishments; Entertainment facilities; Environmental

protection works; Function centres; Home-based child care; Home industries; Horticulture; Information and education facilities; Medical centres; Passenger transport facilities; Places of public worship; Public administration buildings; Recreation areas; Recreation facilities (indoor); Registered clubs; Respite day care centres; Restricted premises; Roads; Service stations; Sex services premises; Shop top housing; Signage; Tourist and visitor accommodation; Veterinary hospitals

4 Prohibited

Any development not specified in item 2 or 3

Given the lack of significant environmental constraints within the land to be impacted by development, the proposed zoning appears suitable provided that direct impacts on the existing endangered ecological communities is avoided. Indirect impacts such as caused by shading, drainage, night light penetration and noise can be mitigated within the site through appropriate setbacks, drainage controls and native planted buffers.

We advise that the land containing endangered ecological communities and recommended managed ecological buffers should be considered as E3 Environmental management.

6.2 Recommended mitigation measures

To minimise adverse ecological impacts, the following mitigation measures are proposed:

1. Those parts of the lands dominated by endangered ecological communities and recommended managed ecological zones to be considered as E3 Environmental management or RE1 Public Recreation.

2. Establishment of managed ecological zones / asset protection zones as buffers between future building footprints and the existing endangered ecological communities and Warriewood Wetlands.

3. Preparation of a vegetation management plan that integrates the design of landscape, stormwater, cut and fill works and ancillary proposed works into a strategic managed ecological zone to only contain native plant species adjoining existing endangered ecological communities and Warriewood Wetlands. The VMP is to include specific measures to:-

    - Undertake regular low impact weed control to minimise establishment and spread of invasive weeds.
    - Manage Edge effects
    - Manage access to all significant habitat areas
    - Undertake revegetation works to maintain arboreal connectivity across the site and provide a transitional buffer between the proposed development and Warriewood Wetlands
    - Sediment and erosion control measures.
    - Nutrient management and runoff mitigation measures (detention basin, bioswale, etc).
    - Habitat enrichment works including planting of foraging species, nest boxes, relocate hollows.

Planting of flowering native vegetation as part of landscape works is recommended to maintain foraging habitat for local fauna, particularly the recorded Grey-headed Flying-fox, and to minimise the impact of the key threatening process, *clearing of native vegetation.*

It is recommended that nest boxes, as part of habitat supplementation, are installed in natural habitat areas prior to any future dismantling of buildings within the subject site. Nest boxes should be constructed from weatherproof material to ensure longevity.

It should be noted that the threatened Eastern Bentwing-bat which was recorded during survey has potential to utilise artificial structures for roosting, but not breeding purposes. As such, any disturbance of a roost during a dismantling process should be effectively managed.

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Attachment 1:

Fauna Survey Effort

Table A1.1 - Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Diurnal birds	8/4/13	4/8 cloud, no wind, no rain, 24°C - 18°C	Census points x4 / Diurnal opportunistic	4hr 45min 1315 - 1800
	9/4/13	7-2/8 cloud, no wind, previous rain, 19°C – 22°C	Diurnal opportunistic	2hr 10min 1320 - 1530
	5/12/16	7/8 cloud, light NNE wind, no rain, 33.3°C	Diurnal opportunistic	2hr 45min 1330 - 1615
Nocturnal birds	8/4/13	0/8 cloud, no wind, no rain, 18°C	Spotlighting Call playback (MO/PO/BO/BB/AB/BSC)	2hr 1800 - 2000 Commenced @1820
Arboreal mammals	8/4/13	0/8 cloud, no wind, no rain, 18°C	Spotlighting Call playback (Koala)	2hr 1800 - 2000 Commenced @ 1820
	9/4/13	7-2/8 cloud, no wind, previous rain, 19°C – 22°C	Recording Swamp Mahogany locations	2hr 10min 1320 - 1530
Terrestrial mammals	8/4/13	4/8 cloud, no wind, no rain, 24°C – 18°C	Spotlighting	2hr 1800 - 2000
Bats	8/4/13	0/8 cloud, no wind, no rain, 18°C	Spotlighting Anabat x1 (passive monitoring)	2hr 1800 - 2000 2hr 10min 1750 - 2000
	9/4/13	Mostly fine	Anabat x1 (passive monitoring)	2hr 30min 1800 - 2030
	5/12/16	8/8 cloud, moderate wind, mod rain - storms, 24-21°C	SM4Bat x2 (passive monitoring)	1730 - overnight x2
Reptiles	8/4/13	4/8 cloud, no wind, no rain, 24°C – 18°C	Diurnal opportunistic	4hr 45min 1315 - 1800
	9/4/13	7-2/8 cloud, no wind, previous rain, 19°C – 22°C	Diurnal opportunistic	2hr 10min 1320 - 1530
Amphibians	8/4/13	0/8 cloud, no wind, no rain, 18°C	Spotlighting & call identification Call playback (Green & Golden Bell Frog)	2hr 1800 - 2000 Commenced @ 1820
	9/4/13	7-2/8 cloud, no wind, previous rain, 19°C – 22°C	Opportunistic call identification	2hr 10min 1320 - 1530

Key: Nocturnal birds targeted (call-playback)
MO - Masked Owl (*Tyto novaehollandiae*),
PO - Powerful Owl (*Ninox strenua*),
BO - Barking Owl (*Ninox connivens*),
BB - Black Bittern (*Ixobrychus flavicollis*),
AB - Australian Bittern (*Botaurus poiciloptilus*),
BSC - Bush Stone-curlew (*Burhinus grallarius*)

Attachment 2:

Flora & Fauna Species Lists

Table A2.1 - Flora species list

Please note that the species list covers a broader study area, typically confined by the boundary of the Warriewood Southern Buffer

Family	Scientific name	Common name
TREES		
Mimosaceae	*Acacia parramattensis*	Sydney Green Wattle
Myrtaceae	*Acmena smithii*	Lillypilly
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Arecaceae	*Archontophoenix alexandrae**	Alexandra Palm
Sterculiaceae	*Brachychiton populneus*	Kurrajong
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Myrtaceae	*Corymbia maculata*	Spotted Gum
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Cyatheaceae	*Cyathea australis*	Rough Tree-fern
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Fabaceae	*Erythrina sykesii**	Coral Tree
Myrtaceae	*Eucalyptus botryoides*	Bangalay / Southern Mahogany
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Moraceae	*Ficus sp.*	Fig
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda
Arecaceae	*Livistona australis*	Cabbage Tree Palm
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Musaceae	*Musa acuminata**	Banana
Oleaceae	*Olea europaea* subsp. *cuspidata**	African Olive
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Salicaceae	*Salix babylonica**	Weeping Willow
Arecaceae	*Syagrus romanzoffiana**	Cocos Palm
Myrtaceae	*Syncarpia glomulifera*	Turpentine
SHRUBS		
Mimosaceae	*Acacia elongata*	Swamp Wattle
Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Mimosaceae	*Acacia saligna*	Orange Wattle
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Solanaceae	*Cestrum parqui**	Chilean Cestrum
Apocnynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Proteaceae	*Hakea salicifolia*	Willow Hakea
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart
Myrtaceae	*Kunzea ambigua*	Tick Bush
Verbenaceae	*Lantana camara**	Lantana
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Celastraceae	*Maytenus silvestris*	-
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey Myrtle
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark

Family	Scientific name	Common name
Araceae	*Monstera deliciosa**	Fruit-salad Plant
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Asteraceae	*Osteospermum fruticosum**	Shrubby Daisy-bush
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Euphorbiaceae	*Ricinus communis**	Castor Oil Plant
Rosaceae	*Rubus fruticosus* sp. agg.*	Blackberry Complex
Cesalpinioideae	*Senna pendula* var. *glabrata**	-
Solanaceae	*Solanum mauritianum**	Wild Tobacco
GROUNDCOVERS		
Polygonaceae	*Acetosa saggitata**	Turkey Rhubarb
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Asteraceae	*Ageratina adenophorum**	Crofton Weed
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Arundo donax**	Giant Reed
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Poaceae	*Axonopus fissifolius**	Narrow-leaf Carpet Grass
Azollaceae	*Azolla pinnata*	Ferny Azolla
Restionaceae	*Baloskion tetraphyllum*	
Cyperaceae	*Baumea juncea*	-
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
Cyperaceae	*Bolboschoenus fluviatilis*	Marsh Clubrush
Dicksoniaceae	*Calochlaena dubia*	False Bracken
Brassicaceae	*Capsella bursa-pastoris**	Shepherds purse
Cyperaceae	*Carex appressa*	Tall Sedge
Apiaceae	*Centella asiatica*	Swamp Pennywort
Liliaceae	*Chlorophytum comosum**	Spider Plant
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Asteraceae	*Conyza sumatrensis**	Fleabane
Poaceae	*Cortaderia selloana**	Pampas Grass
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery
Poaceae	*Cynodon dactylon*	Common Couch
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Cyperaceae	*Cyperus gracilis*	-
Cyperaceae	*Cyperus polystachyos*	-
Cyperaceae	*Cyperus rotundatus**	-
Phormiaceae	*Dianella caerulea*	Flax Lily
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Pontederiaceae	*Eichornia crassipes**	Water Hyacinth
Poaceae	*Entolasia stricta*	Wiry Panic
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Asteraceae	*Erechtites valerianifolia**	Brazilian Fireweed
Euphorbiaceae	*Euphorbia peplus**	Spurge
Cyperaceae	*Facinia nodosa*	-
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Geraniaceae	*Geranium homeanum*	Northern Cranesbill

Family	Scientific name	Common name
Zingiberaceae	*Hedychium gardnerianum**	Ginger Lily
Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Clusiaceae	*Hypericum perforatum**	St Johns Wort
Asteraceae	*Hypochaeris glabra**	Smooth Catsear
Asteraceae	*Hypochaeris radicata**	Flatweed
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Juncaceae	*Juncus usitatus*	Common Rush
Liliaceae	*Lilium formosanum**	Formosan Lily
Onagraceae	*Ludwigia peruviana**	Water Primrose
Lamiaceae	*Mentha* sp.*	Mint
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Poaceae	*Oplismenus aemulus*	Basket Grass
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel
Urticaceae	*Parietaria judaica**	wall pellitory
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polygonaceae	*Persicaria strigosa*	-
Poaceae	*Phragmites australis*	Common Reed
Plantaginaceae	*Plantago lanceolata**	Ribwort
Portulacaceae	*Portulaca oleracea*	Purslane
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup
Polygonaceae	*Rumex crispus**	Curled Dock
Cyperaceae	*Schoenoplectus validus*	River Club-rush
Cyperaceae	*Schoenus brevifolius*	Bog-rush
Asteraceae	*Senecio madagascariensis**	Fireweed
Poaceae	*Setaria parviflora**	-
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Solanaceae	*Solanum nigrum**	Black Nightshade
Asteraceae	*Soliva sessilis**	Jojo
Asteraceae	*Sonchus asper* subsp. *asper**	Prickly Sowthistle
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Strelitzeaceae	*Strelitzea juncea**	Bird of Paradise
Asteraceae	*Tagetes minuta**	Stinking Roger
Asteraceae	*Taraxacum officinale**	Dandelion
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach
Commelinaceae	*Tradescantia albiflora**	Wandering Jew
Fabaceae	*Trifolium repens**	White Clover
Juncaginaceae	*Triglochin microtuberosum*	Water Ribbons
Typhaceae	*Typha orientalis*	Cumbungi
Scrophulariaceae	*Verbascum virgatum**	Twiggy Mullein
Verbenaceae	*Verbena bonariensis**	Purpletop
Verbenaceae	*Verbena litoralis**	Coastal Verbena

Family	Scientific name	Common name
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Violaceae	*Viola odorata**	Sweet Violet
Iridaceae	*Watsonia meriana**	Wild Watsonia
VINES		
Basellaceae	*Anredera cordifolia**	Madiera Vine
Apocnyaceae	*Araujia sericifolia**	Mothvine
Sapindaceae	*Cardiospermum grandiflorum**	Balloon Vine, Love in a Puff
Vitaceae	*Cayratia clematidea*	Slender Grape
Dioscoreaceae	*Dioscorea transversa*	Native Yam
Convolvulaceae	*Ipomoea indica**	Coastal Morning Glory
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Passifloraceae	*Passiflora edulis**	Common Passionfruit
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Fabaceae	*Vicia sativa* subsp. *sativa**	Common Vetch

Table A2.2 - Fauna species list

Common name	Scientific name	Method observed
Birds		**April 2013 / Dec 2016**
Australian Brush-turkey	*Alectura lathami*	O
Australian Magpie	*Gymnorhina tibicen*	O C
Australian Raven	*Corvus coronoides*	O C
Brown Thornbill	*Acanthiza pulsilla*	C
Chestnut Teal	*Anas castanea*	O C
Common Bronzewing	*Phaps chalcoptera*	O
Common Koel	*Eudynamys scolopacea*	O C
Common Myna *	*Acridotheres tristis*	C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O C
Eastern Whipbird	*Psophodes olivaceus*	C
Galah	*Cacatua roseicapilla*	O C
Golden Whistler	*Pachycephala pectoralis*	O C
Grey Butcherbird	*Cracticus torquatus*	C
Grey Fantail	*Rhipidura fuliginosa*	O C
Laughing Kookaburra	*Dacelo novaeguineae*	O C
Magpie-lark	*Grallina cyanoleuca*	O
Masked Lapwing	*Vanellus miles*	O C
Musk Lorikeet	*Glossopsitta concinna*	O C
Noisy Miner	*Manorina melanocephala*	C
Olive-backed Oriole	*Oriolus sagittatus*	O C
Pacific Black Duck	*Anas superciliosa*	O
Pied Currawong	*Strepera graculina*	O C
Purple Swamphen	*Porphyrio porphyrio*	O C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Red Junglefowl *	*Gallus gallus*	O C
Red Wattlebird	*Anthochaera carunculata*	C
Red-whiskered Bulbul *	*Pycnonotus jocosus*	O C
Silvereye	*Zosterops lateralis*	O C
Spotted Pardalote	*Pardalotus punctatus*	C
Spotted Turtle-Dove *	*Streptopelia chinensis*	O
Sulphur Crested Cockatoo	*Cacatua galerita*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Tawny Frogmouth	*Podargus strigoides*	O
Variegated Fairy-wren	*Malurus lamberti*	O C
White-browed Scrubwren	*Sericornis frontalis*	O C
White-cheeked Honeyeater	*Phylidonyris nigra*	C
Willie Wagtail	*Rhipidura leucophrys*	O C
Yellow Thornbill	*Acanthiza nana*	O C
Mammals		
Black Rat *	*Rattus rattus*	T
Common Brushtail Possum	*Trichosurus vulpecula*	S
Common Ringtail Possum	*Pseudocheirus peregrinus*	S
Domesticated Dog *	*Canis familiaris*	O
Eastern Bentwing-bat TS	*Miniopterus orianae oceansis*	A
Eastern Freetail-bat	*Mormopterus ridei*	A PO
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Grey-headed Flying-fox TS	*Pteropus poliocephalus*	S
Horse *	*Equus caballus*	O

Common name	Scientific name	Method observed
Large-footed Myotis[TS]	*Myotis macropus*	A [PO]
Little Forest Bat	*Vespadelus vulturnus*	A
Rabbit *	*Oryctolagus cuniculus*	S
Reptiles		
Delicate Skink	*Lampropholis delicata*	O
Eastern Water Dragon	*Intellagama lesueurii*	O
Eastern Water Skink	*Eulamprus quoyii*	O
Red-Bellied Black Snake	*Pseudechis porphyriacus*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	C
Dwarf Tree Frog	*Litoria fallax*	C
Striped Marsh Frog	*Limnodynastes peronii*	C

Note: * indicates introduced species
[TS] indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

[PR] indicates species identified to a 'probable' level of certainty
[PO] indicates species identified to a 'possible' level of certainty

A	-	Anabat II/SD-1	C	-	Call identification
O	-	Observation	P	-	Call-playback response
T	-	Trap (*Elliott*, cage, etc)	H	-	Habitat search
S	-	Spotlight	I	-	Scat, track or sign identification

Attachment 3:

Threatened Flora & Fauna
Habitat Assessment

Table A3.1 - Threatened flora habitat assessment

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Acacia bynoeana OEH EPBC	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll Open Forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	x	marginal	x	x	unlikely	x
Acacia terminalis subsp. *terminalis* OEH EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. Typically restricted to the Port Jackson and eastern suburbs of Sydney.	x	x	-	-	x	x
Asterolasia elegans OEH EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	x	x
Boronia umbellata OEH	V	V	Orara Boronia is an open shrub, 1 – 2m tall. Geographically restricted to Glenreagh and Lower Bucca, north of Coffs Harbour where it grows around gullies in wet open forest.	x	x	-	-	x	x
Caladenia tessellata EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	x	marginal	x	x	unlikely	x
Callistemon linearifolius OEH	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	x	limited	✓	x	low	✓

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Chamaesyce psammogeton OEH	E1	-	Prostrate herb. Coastal dunes. Distribution limits N-Tweed Heads S-Jervis Bay	x	x	-	-	x	x
Cryptostylis hunteriana OEH EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	marginal	x	x	unlikely	x
Darwinia biflora OEH EPBC	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. Distribution limits N-Gosford S-Cheltenham.	x	x	-	-	x	x
Deyeuxia appressa EPBC	E1	E	Erect grass to 0.9m high. Grows on wet ground. Distribution limits N-Hornsby S-Bankstown.	x	marginal	x	x	unlikely	x
Diuris bracteata OEH	E1	Extinct	An orchid that grows in dry sclerophyll woodland. Was thought to be extinct until approximately 10yrs ago. Found in the Sydney Basin Bioregion. Flowers in September.	x	x	-	-	x	x
Epacris purpurascens var. *purpurascens* OEH	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eucalyptus camfieldii OEH EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N-Norah Head S-Royal NP.	x	x	-	-	x	x
Eucalyptus nicholii OEH	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.	x	x	-	-	x	x
Eucalyptus scoparia OEH	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	x	x	-	-	x	x
Genoplesium baueri OEH EPBC	E1	-	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Distribution limits N – Hunter Valley S – Nowra	x	x	-	-	x	x
Grammitis stenophylla OEH	E1	-	A small lithophytic fern with fronds generally <5cm. Occurs in rainforest and wet sclerophyll forest in the coastal divisions of NSW.	x	x	-	-	x	x
Grevillea caleyi OEH EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. Distribution limits Terrey Hills-Belrose area.	x	x	-	-	x	x
Haloragodendron lucasii OEH EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau and Mt Wilson.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Hibbertia puberula OEH	E1	-	Shrublets with branches up to 30cm long. Not been seen for 40 years however early records are from Hawkesbury River area in Sydney and the Blue Mountains.	x	x	-	-	x	x
Hibbertia superans OEH	E1	-	Small spreading shrub to 0.3m high. Grows on sandstone, usually in or near SSTF. Distribution limits N-Glenorie S-Kellyville disjunct Mt Boss.	x	x	-	-	x	x
Kunzea rupestris OEH EPBC	V	V	Shrub to 1.5m high. Grows in cracks and fissures on Hawkesbury sandstone rock platforms. Distribution limits N-Maroota S-Glenorie.	x	x	-	-	x	x
Lasiopetalum joyceae OEH	V	V	Erect shrub to 2m high. Grows in heath and open forest on Hawkesbury sandstone. Distribution limits Hornsby Plateau.	x	x	-	-	x	x
Leptospermum deanei OEH EPBC	V	V	Shrub to 5m high. Grows on forested slopes. Distribution limits Near watershed of Lane Cove River.	x	x	-	-	x	x
Melaleuca biconvexa EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	x	✓	x	x	low	✓
Melaleuca deanei OEH EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Microtis angusii OEH EPBC	E1	E	Terrestrial orchid which is known from two populations, Mona Vale and Sunny Corner. Grows in well-drained laterite in grassy woodland.	x	x	-	-	x	x
Pelargonium sp. *Striatellum* EPBC	E1	E	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Varied distribution from SE NSW to QLD.	x	x	-	-	x	x
Persoonia hirsuta OEH EPBC	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. Distribution limits N-Glen Davis S-Hill Top.	x	x	-	-	x	x
Persoonia laxa OEH	E4	Extinct	Decumbent or prostrate shrub. Not been seen since 1908. Once recorded in Newport and Manly.	x	x	-	-	x	x
Persoonia mollis subsp. *maxima* OEH	E1	E	Erect to prostrate shrub. Grows in moist to wet sclerophyll forests on Hawkesbury sandstone. Distribution limits N-Cowan S-Hornsby.	x	x	-	-	x	x
Pimelea curviflora var. *curviflora* OEH	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	x	x	-	-	x	x
Prostanthera junonis OEH	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. Distribution limits Somersby region.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Prostanthera marifolia OEH EPBC	E4a	Critic . E	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. Has been recorded previously in the Sydney Harbour region.	x	x	-	-	x	x
Senecio spathulatus OEH	E	-	A low growing daisy that prefers primary dunes. Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.	x	x	-	-	x	x
Syzygium paniculatum OEH EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	x	x	-	-	x	x
Tetratheca glandulosa OEH EPBC	V	V	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	x	x	-	-	x	x
Thesium australe EPBC	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
Triplarina imbricata EPBC	E1	E	A shrub to 2.8m tall, flowers from Nov-Dec. Occurs in heath, often in damp places along creek lines; coast and adjacent ranges. Known from the Tabulum and Nymboida districts in NE NSW.	x	x	-	-	x	x

OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded on site				To be considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
V	- Denotes vulnerable listed species under the relevant Act								
E or E1	- Denotes endangered listed species under the relevant Act								
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.								

Table A3.2 - Threatened fauna habitat assessment

Common name ***Scientific name*** DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Giant Burrowing Frog *Heleioporus australiacus* OEH EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution Limit: N-Near Singleton S-South of Eden.*	×	×	-	-	×	×
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution Limit: N-near Tenterfield S-South of Bombala*.	×	×	-	-	×	×
Red-crowned Toadlet *Pseudophryne australis* OEH	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. *Distribution Limit: N-Pokolbin. S-near Wollongong.*	×	×	-	-	×	×
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-Byron Bay S-South of Eden.*	×	✓	×	×	unlikely	✓
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution Limit: N-Hunter River S-Eden.*	×	×	-	-	×	×

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Rosenberg's Goanna *Varanus rosenbergi* OEH	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. *Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.*	×	×	-	-	×	×
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. *Distribution Limit: N-Mudgee Park. S-Nowra.*	×	×	-	-	×	×
Wompoo Fruit-dove *Ptilinopus magnificus* OEH	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. *Distribution Limit: N-Tweed Heads. S-Sydney.*	×	×	-	-	×	×
Superb Fruit-dove *Ptilinopus superbus* OEH	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. *Distribution Limit: N-Border Ranges National Park. S-Bateman's Bay.*	×	×	-	-	×	×

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Australasian Bittern *Botaurus poiciloptilus* OEH EPBC	E	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. *Distribution Limit: N-North of Lismore. S- Eden.*	×	marginal	✓	✓	low	✓
Black Bittern *Ixobrychus flavicollis* OEH	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	✓	✓
Little Eagle *Hieraaetus morphnoides* OEH	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution Limit - N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	✓	✓
Square-tailed Kite *Lophoictinia isura* OEH	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. *Distribution Limit: N-Goondiwindi. S-South of Eden.*	×	✓	×	✓	✓	✓

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Osprey *Pandion haliaetus* OEH	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	marginal	✓	✓	✓	✓
Bush Stone-curlew *Burhinus grallarius* OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution Limit: N-Border Ranges National Park. S-Near Nowra.*	×	✓	×	✓	low	✓
Sooty Oystercatcher *Haematopus fuliginosus* OEH	V	-	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Pied Oystercatcher *Haematopus longirostris* OEH	V	-	Inhabits coastal beaches and estuarine flats. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Australian Painted Snipe *Rostratula australis* EPBC	V	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	unlikely	×

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution Limit: mid north coast of NSW to western Victoria.*	×	✓	×	×	unlikely	✓
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Little Lorikeet *Glossopsitta pusilla* OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution Limit: N-Tweed Heads. S-South of Eden*.	×	✓	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* OEH EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	×	✓	✓	×	✓	✓
Turquoise Parrot *Neophema pulchella* OEH	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. *Distribution Limit: N-Near Tenterfield. S-South of Eden.*	×	×	-	-	×	×

Common name ***Scientific name*** DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Barking Owl *Ninox connivens* OEH	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	✓	✓	✓	✓	✓
Powerful Owl *Ninox strenua* OEH	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	✓	✓	✓	✓	✓
Masked Owl *Tyto novaehollandiae* OEH	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. *Distribution Limit: N-Border Ranges National Park. S-Eden.*	×	✓	×	×	unlikely	✓
Sooty Owl *Tyto tenebricosa* OEH	V	-	Tall, dense, wet forests containing trees with very large hollows. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	×	-	-	×	×
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Black-chinned Honeyeater *Melithreptus gularis gularis* OEH	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. *Distribution Limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.*	×	marginal	×	✓	Not likely	×
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution Limit: N-Urbanville. S-Eden.*	×	✓	✓	×	low	✓
Painted Honeyeater *Grantiella picta* OEH EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. *Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.*	×	✓	×	×	Not likely	×
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	×	✓	✓	✓	✓	✓

Common name ***Scientific name*** DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Dusky Woodswallow *Artamus cyanopterus cyanopterus* OEH	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. *Widespread in eastern, southern and southwestern Australia.*	×	Sub-optimal	×	×	unlikely	✓
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	unlikely	✓
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	marginal	×	✓	unlikely	✓

Common name *Scientific name* DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat *Distribution limit*	Recorded on site (✓)	If not recorded on site				Considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur (study area)	
Southern Brown Bandicoot *Isoodon obesulus* OEH EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution Limit: N-Kempsey. S-South of Eden.*	×	marginal	×	×	Not likely	×
Koala *Phascolarctos cinereus* OEH EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	marginal	✓	×	unlikely	✓
Eastern Pygmy Possum *Cercatetus nanus* OEH	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. *Distribution Limit: N-Tweed Heads. S-Eden.*	×	×	-	-	×	×
Greater Glider *Petauroides volans* OEH EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows *Distribution Limit: N-Border Ranges National Park. S- South of Eden.*	×	×	-	-	×	×

Common name *Scientific name* DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat *Distribution limit*	Recorded on site (✓)	If not recorded on site				Considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur (study area)	
Squirrel Glider *Petaurus norfolcensis* OEH	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. *Distribution Limit: N-Tweed Heads. S-Albury.*	×	✓	×	×	Not likely	×
Long-nosed Potoroo *Potorous tridactylus* EPBC	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	×	-	-	×	×
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution Limit: N-North of Tenterfield. S-Bombala.*	×	×	-	-	×	×
Grey-headed Flying-fox *Pteropus poliocephalus* OEH EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution Limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
East-coast Freetail Bat *Micronomus norfolkensis* OEH	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. *Distribution Limit: N-Woodenbong. S-Pambula.*	×	✓	✓	✓	✓	✓
Large-eared Pied Bat *Chalinolobus dwyeri* OEH EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution Limit: N-Border Ranges National Park. S-Wollongong.*	×	marginal	✓	✓	✓	✓
Little Bentwing-bat *Miniopterus australis* OEH	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. *Distribution Limit: N-Border Ranges National Park. S-Sydney.*	×	✓	✓	✓	✓	✓
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	✓	-	-	-	-	✓
Large-footed Myotis *Myotis macropus* OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limits: N-Border Ranges National Park. S-South of Eden.*	×	✓	✓	✓	✓	✓

Common name ***Scientific name*** **DATABASE SOURCE**	**TSC Act**	**EPBC Act**	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in 7 part test of significance (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** ***Notes 1,2 & 3***	**Record(s) from recent years (✓)** ***Notes 1,2 & 3***	**Potential to occur (study area)**	
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	✓	×	✓	low	✓
New Holland Mouse *Pseudomys novaehollandiae* EPBC	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	marginal	×	✓	Not likely	×
Macquarie Perch *Macquaria australasica* EPBC	V	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	×	×	-	-	×	×

Common name *Scientific name* DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat *Distribution limit*	Recorded on site (✓)	If not recorded on site				Considered in 7 part test of significance (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur (study area)	
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg weirs, waterfalls).	×	×	-	-	×	×

OEH	-	Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'records' refer to those provided by the *Atlas of NSW Wildlife*
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

Table A3.3 – Migratory fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Oriental or Horsfield's Cuckoo (*Cuculus optatus*)	It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	✓	×	-
Yellow Wagtail (*Motacilla flava*)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	×	-	-
Bar-tailed Godwit (*Limosa lapponica*)	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	×	-	-
Common Greenshank (*Tringa nebularia*)	Found in a wide variety of inland wetlands and sheltered coastal habitats (with large mudflats and saltmarsh, mangroves or seagrass) of varying salinity, Habitats include embayments, harbours, river estuaries, deltas and lagoons. It uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. Also artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. In NSW the Hunter River estuary has been identified as a site of international importance. *Breeds in Eurasia, the northern British Isles, Scandanavia, east Estonia and north-east Belarus, through Russia and east.*	marginal	×	-
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	✓	×	-
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	×	-

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south-east and south-west Australia.*	×	-	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south-east Australia, otherwise uncommon*.	✓	×	-
Spectacled Monarch (*Monarcha trivirgatus*)	Understorey of mountain/lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. *Summer breeding migrant to south east Qld and north east NSW down to Port Stephens from Sept / Oct to May. Uncommon in southern part of range.*	marginal	×	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south east Australia and Tasmania over warmer months, winters in north east Qld.*	✓	×	-
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.*	✓	×	-
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	✓	×	-
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW*.	✓	×	-

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	✓	x	-
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	✓	x	-
Little Tern (Sternula albifronds)	In Australia, Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches. Little Terns nest on sand-spits, banks, ridges or islets and also on wide and flat or gently sloping sandy ocean beaches, and occasionally in sand-dunes. Forage in shallow waters of estuaries, coastal lagoons and lakes, frequently over channels next to spits and banks or entrances, and often close to breeding colonies. They also forage along open coasts, especially around bars off the entrances to rivers and lagoons, less often at sea, and usually within 50 m of shore.	x	-	-

Attachment 4:

7 Part Test of Significance
(Section 5A EPA Act 1979)

7 Part Test of Significance

(Section 5A EPA Act 1979)

Council, or the authorising authority is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed SIS.

Flora and fauna investigations and habitat assessments of the study area have resulted in the identification of suitable habitat for the following threatened species and populations with varying potential to occur. Species recorded or with a considered potential to occur have been noted. The potential for any direct or indirect impacts on these species has also been considered and noted.

Threatened flora

Scientific name	*TSC Act*	Potential to occur	Potential impact
Callistemon linearifolius	V	low	Impact to a small area of potential habitat and potential cumulative indirect impact on potential habitat.
Melaleuca biconvexa	V	low	Impact to a small area of potential habitat and potential cumulative indirect impact on potential habitat.

Threatened fauna

COMMON NAME	TSC Act	Potential to occur	Potential impact
Grey-headed Flying-fox	V	recorded	Indirect - unlikely on roosting/breeding. Direct - on foraging
Eastern Bentwing-bat	V	recorded	None anticipated
Black Bittern	V	✓	None anticipated
Little Eagle	V	✓	Direct - on low potential foraging
Square-tailed Kite	V	✓	Direct - on low potential foraging
Osprey	V	✓	None anticipated
Little Lorikeet	V	✓	Direct - on potential foraging
Swift Parrot	E	✓	None anticipated
Barking Owl	V	✓	Direct - on potential foraging
Powerful Owl	V	✓	Direct - on potential foraging
Varied Sittella	V	✓	Direct - on potential foraging
East-coast Freetail Bat	V	✓	None anticipated
Large-eared Pied Bat	V	✓	None anticipated
Little Bentwing-bat	V	✓	None anticipated
Large-footed Myotis	V	✓	None anticipated
Australasian Bittern	E	low	None anticipated
Bush Stone-curlew	E	low	Direct - on unlikely potential foraging
Regent Honeyeater	E4A	low	Direct - on unlikely potential foraging
Greater Broad-nosed Bat	V	low	Direct - on low potential foraging
Green and Golden Bell Frog	E	unlikely	Direct - on unlikely potential shelter / overwintering

COMMON NAME	TSC Act	Potential to occur	Potential impact
Australian Painted Snipe	V	unlikely	None anticipated
Gang-gang Cockatoo	V	unlikely	Direct - on unlikely potential foraging
Masked Owl	V	unlikely	Direct - on unlikely potential foraging
Dusky Woodswallow	V	unlikely	Direct - on unlikely potential foraging
Scarlet Robin	V	unlikely	Direct - on unlikely potential foraging
Spotted-tailed Quoll	V	unlikely	Direct - on unlikely potential foraging
Koala	V	unlikely	None anticipated

Endangered populations

- The Koala population in the Pittwater LGA,
- The Squirrel Glider population on Barrenjoey Peninsula.

There are no endangered flora populations for the Northern Beaches LGA (nor former Pittwater LGA), or located within 10km of the development site boundary

Endangered ecological communities

- Swamp Oak Floodplain Forest
- Freshwater Wetlands on Coastal Floodplains

The 7 part test of significance is as follows:

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The direct impacts of the proposal within the subject site are considered as:

- Removal/modification of 0.23 ha of Disturbed Bangalay / Apple Forest
- Limited modification of Swamp Oak Floodplain Forest for potential walking/bicycle track between the development (southern edge) and Centro shopping centre, estimated at 50 linear metres to wind through existing trees and shrubs
- Subsequent removal of potential seasonal foraging habitat for threatened fauna species

The potential indirect impacts of the proposal from the subject site are considered as:

- Edge effects such as weed incursions into the adjacent vegetation
- Cumulative hydrological changes to the adjacent wetlands from alteration of runoff capacity and infiltration
- Rubbish and debris entering wetland areas
- Increased access into wetland areas
- More light / noise impacts upon local fauna
- Reduced cross-site movements by small bird species such as passerines
- Increased human presence and spill-over effects such as noise and lighting into adjacent natural habitats, particularly the Warriewood Wetlands.

With consideration to the relative direct and indirect impacts on all threatened species with varying potential to occur, it is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of

extinction. Species recorded present during survey, previously recorded nearby or with high potential to occur and requiring further discussion given potential impacts are further discussed in detail below.

Summary of threatened species recorded

Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)

The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer 1995). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1995). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995). Roost sites in tree hollows have not been reported within the literature reviewed.

This species has not been identified as utilising culverts for maternity roosts. Maternity roosts rather are occupied by up to 100, 000 females with only twelve (12) maternity roosts known throughout the complete range (Hoy & Hall 2008).

The Eastern Bentwing-bat was recorded foraging at both *Anabat* stations during 2013 survey (see Figure 4 for recorded locations). It is considered that the subject site provides suitable foraging habitat throughout for this species. Roosting habitat may be present in old buildings and structures present as well as within culverts along Narrabeen Creek, however, no suitable breeding habitat is present.

Given that suitable foraging and roosting habitat remains well represented in the locality and no important roosting habitat will be likely impacted it is considered that the planning proposal *will not cause a significant impact on this species.*

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally, foraging is within 20km of camps, however, individuals are known to commute up to 50km to a productive food source.

An individual Flying-fox was recorded foraging within the subject site during 2013 nocturnal survey. The flowering trees species of foraging use was not recorded at this time however the recorded location is shown on Figure 4. The subject site therefore provides recorded seasonal foraging habitat for the Grey-headed Flying-fox.

A small roosting camp of approximately 100 individuals was also recorded roosting approximately 150m to the south west during 2013 survey (refer to Figure 4). This roosting location was at the north western edge of the *Centro* shopping complex within the more

suitable roosting habitat of Warriewood Wetlands. Roosting camps are where diurnal roosting and breeding takes place and thus such camps are critical to this species and their protection is of priority in their conservation efforts. Such camps may also seasonally swell in size with the influx of numerous other individuals as foraging resources in the locality become available.

Therefore there is some potential that the area occupied by this camp may utilise habitat closer to the study area on occasion. We do not anticipate that such habitat use at these times is likely to include the study area or to be indirectly impacted by the proposal. However, given the height of the proposal up to 4 storeys, lighting impacts and spill-over into the wetland area will need to be carefully considered. These impacts may however not be comparable to the recently constructed multi-storey apartments on the adjacent property to the north. It should also be noted here that the core area of the camp is located directly behind the *Centro* shopping complex and its associated lighting and rear access.

Impacts of the flying-fox camp on the development should alternatively also be considered. This was not observed to be a large camp at the time of the previous survey however when camps are large, particularly when they receive a seasonal influx in numbers, they can cause noise, smell and notably acid laden droppings on nearby assets. When individuals come to return to the camp after nightly foraging forays they often roost in nearby surrounding trees where they will make noise and droppings before returning to the core roosting area. Such dropping may impact on vehicles, clothes washing and seating below trees but also may scatter on open pedestrian surfaces.

Therefore the proposal will remove some seasonally available foraging trees close to the local roosting camp and may cause some indirect impacts on this camp at times when it seasonally swells to accommodate more individuals. The removal of a small amount of foraging habitat and the low potential indirect impacts considered are not likely to significantly impact on the local Grey-headed Flying-fox population, particularly such that it would cause local extinction. Some mitigation measures such as tree planting and considerations to lighting have been proposed to reduce the effect of identified impacts.

The Swamp Mahogany trees present within the study area on the eastern side of Boondah Road (refer to Figure 4) likely offer unique winter foraging resources for this species within the locality. These trees are outside of the proposed development lots and *will not likely be significantly impacted.*

Large-footed Myotis *(Myotis macropus)*

The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). The Large-footed Myotis predominantly forages along creeklines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards 1995).

This species has a strong association with streams and permanent waterways, most frequently at low elevations and in flat or undulating country and usually in areas that are vegetated rather than cleared. They will live in most habitat types as long as it is near water (Churchill 2008).

The Large-footed Myotis was recorded only to a ‘possible’ level of certainty from a single recorded pass of an ultrasonic recorder during recent 2016 survey along the Narrabeen Creek. The recorded location was not within the subject site area but nearby to the south.

The subject site itself does not provide any foraging or likely important roosting or breeding habitat. The planning proposal is not likely to indirectly impact on any locally important habitat. *Therefor the planning proposal is not likely to significantly impact on a local population of this species.*

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Two (2) endangered fauna populations are recorded within 10km of the study area. These include the Koala population in the Pittwater LGA and the Squirrel Glider population on Barrenjoey Peninsula.

The Squirrel Glider population is identified north of Bushrangers Hill which is located more than 3km to the north of the study area. There are no records of Squirrel Glider within this distance and therefore the study area is not considered to contribute any habitat of importance to this population.

Koalas forming part of the endangered population have been previously recorded in the locality surrounding the study area. These records are mostly prior to 1950 with the most recent nearby record located north of the study area in 1975. All of these nearby Koala records are to a 1km accuracy, suggesting they were estimated / approximate locations of historical sightings. The study area contains a mature stand of Swamp Mahogany trees located between Boondah Road and Narrabeen Creek, as well as along the fringes of the Warriewood Wetlands.

There is no doubt that the Swamp Mahogany trees present within the study area would have formed important habitat for the local Koala population when this population was previously well represented in the nearby locality. Habitat removal, fragmentation and isolation in the Pittwater LGA over the last hundred years or so has put high pressures on this population which has diminished to what now appears a non-viable population. Stressed Koalas competing with urban landscapes are more susceptible to disease and poor population dynamics.

Based on records alone, it is unlikely that any remaining Koalas that cling onto remaining habitats in the Pittwater LGA still utilise the available habitat present within the study area. Locations of Swamp Mahogany observed during the flora survey within and near to the study area are shown on Figure 4. This tree is not only an important Koala feed tree but is a profuse winter flowering resource to nectar dependent fauna, including the endangered migratory Swift Parrot which has also been recorded in the locality. No Swamp Mahogany trees are present within the three lots making up the current development proposal on the western side of Boondah Road. These Swamp Mahogany trees will also be continually available to free ranging local Koalas which have an ‘unlikely’ potential to occur.

There are no endangered flora populations within the Northern Beaches LGA or former Pittwater LGA. There are also no endangered flora populations within a 10km radius of the development site boundary.

Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these species is likely to be placed at risk of extinction.

c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Swamp Oak Floodplain Forest and Freshwater Wetlands on Coastal Floodplains

The planning proposal has been sited to minimise direct impacts upon the community with the intent on using the boundary of the community as the setback to development. There will be no direct impact upon Swamp Oak Floodplain Forest or Freshwater Wetlands on Coastal Floodplains from the main development, however there may me a minor linear impact if a boardwalk is constructed to Centro shopping centre. Within no. 10 and 12 Boondah Road, and 6 Jacksons Road, there is 1.50 ha of Swamp Oak Floodplain Forest. This vegetation continues along Narrabeen Creek in the locality and into parts of Warriewood Wetlands. The Warriewood wetlands are a mosaic of vegetation types, mostly being these two (2) EECs as well as some Swamp Sclerophyll Forest on Coastal Floodplains. These wetlands have demonstrated considerable resilience given their proximity to shopping centres, commercial premises, semi-rural landscapes and residential developments. The addition of mixed use (B2) development with a combination of retail and residential development will add to the overall cumulative impacts upon both communities.

The size of the planning proposal in consideration to the existing developments surrounding Warriewood Wetlands is very small, but each has a cumulative impact. They each may exacerbate indirect impacts through changes to local hydrological function (very import adjacent to wetlands), increased access, potential for rubbish dumping and debris, and sedimentation / erosion.

Whilst the planning proposal will incur a slight increase in both direct and indirect impacts, this particular proposal is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

Nutrients and changes to hydrology may have minor impacts upon the composition of vegetation community. Also, edge effects and the addition of weeds and garden escapes may impact the adjoining vegetation, changing the local composition.

It should be noted that much of the interface between the native vegetation and cleared lands is heavily impacted by weed invasion. This may also have been attributed to nutrients in the past from semi-rural land uses including the stocking of grazing animals such as horses.

The planning proposal again has potential to contribute to the factors which change native vegetation community composition, but considering the extensive commercial / retail development, and residential development around the Warriewood Wetlands, this proposal is likely to have minimal impacts overall and may be balanced through remediation works including access control, weed control, revegetation and sediment and erosion control.

The proposal has been generally set back from existing native vegetation such that the proposed asset protection zones are external, minimising the risk of removing one of more layers of vegetation and limiting composition impacts.

It is unlikely that the planning proposal will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Callistemon linearifolius, Melaleuca biconvexa,* Swamp Oak Floodplain Forest, Freshwater Wetlands on Coastal Floodplains*,* Green and Golden Bell Frog, Australasian Bittern, Black Bittern, Little Eagle, Square-tailed Kite, Osprey, Bush Stone-curlew, Australian Painted Snipe, Gang-gang Cockatoo, Little Lorikeet, Swift Parrot, Turquoise Parrot, Barking Owl, Powerful Owl, Masked Owl, Regent Honeyeater, Varied Sittella, Dusky Woodswallow, Scarlet Robin, Spotted-tailed Quoll, Koala, Grey-headed Flying-fox, East-coast Freetail Bat, Large-eared Pied Bat, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis and Greater Broad-nosed Bat.

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The development site area is approximately 3.56 ha and contains 1.71 ha of native vegetation. It is anticipated that the planning proposal would impact upon 0.21 ha of Disturbed Bangalay / Apple Forest, and a further 0.02 ha which is in the road corridor for the above mentioned species. Note that cleared and modified / managed vegetation may provide some highly limited foraging opportunities for a few select species.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The planning proposal will retain all native vegetation that forms part of an existing arboreal/terrestrial connectivity along the western boundary. Connectivity along Narrabeen creek to the south and extending to the east and north-east will remain as part of the proposal. Therefore areas of habitat are unlikely to be fragmented or isolated from other areas of habitat as a result of the proposal.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The planning proposal has been sighted to ensure no direct impact on EEC vegetation, with the exception of a possible boardwalk link to Centro shopping centre, which can be undertaken within a weed infested area that would unlikely require the removal of trees or mid-storey, therefore the impact is minimal.

The native vegetation along the western edge will be retained, which forms a connected corridor, with a tertiary link along Narrabeen Creek across Boondah Road. The links will remain as they are with no reduction to width.

The proposal will not cause any areas of vegetation or habitat to be fragmented or isolated.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Draft state recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Barking Owl (*Ninox connivens*) (NPWS 2003)
- Green and Golden Bell Frog (*Litoria aurea*) (DEC 2005)

Approved state recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Koala (*Phascolarctos cinereus*) (DEC 2008)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006).

It is considered that the planning proposal is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined in the *TSC Act* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes under the *TSC Act*, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*)		✓	
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	✓		
Anthropogenic Climate Change			✓
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)		✓	
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
psyllids and bell miners			
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers	✓		
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*			✓
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees			✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	✓		
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)		✓	
Predation by Gambusia holbrooki Girard, 1859 (plague minnow or mosquito fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees	✓		

The above key threatening processes have been considered in reference to the proposal. It was considered that the proposal may contribute to a small degree to a number these processes as described below. It was not considered that the proposal will have a large or significant impact on any of the following key threatening processes. Some mitigation measures have been listed under each process to minimise or reduce such impacts upon those processes.

Summary of "likely" or "possible" Key Threatening Processes

This section identifies what mitigation measures can be implemented to address threatening processes.

Aggressive exclusion of birds by Noisy Miners (Manorina melanocephala)

Noisy Miners have been recorded present within the study area. It is likely that Noisy Miners from within the study area may be slightly displaced as a result of habitat removal for the development, resulting in increased impacts from this species on other native birds in the nearby surrounds, potentially also into the wetland areas. Given the high degree of disturbance in the local surrounds it is expected that the Noisy Miner is already at impacting numbers in these areas.

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

Most developments will have some incremental or cumulative affection on local hydrology, particularly if they are sited adjacent to drainage lines or wetlands.

The planning proposal will contain impermeable surfaces which could increase runoff and various nutrients into Narrabeen Creek and Warriewood Wetlands.

Impacts should be mitigated through raingardens, bioswales or detention ponds that slow and filter runoff. Sediment and erosion control is to be enacted prior to the commencement of construction works.

Clearing of native vegetation

A total of 0.23 ha of native vegetation is likely to be removed or modified by the proposal, which contributes to a cumulative impact in the local area. This may be partially compensated through revegetation, regeneration works and weed control of the riparian areas and adjoining fringe to Warriewood wetlands.

The removal of native vegetation is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation conserved within the local reserve system, and the small area of vegetation to be removed.

Competition and grazing by the feral European rabbit

It is expected that the planning proposal will likely decrease the potential for rabbit invasion by greater management of open grassy foraging area. Rabbit management and control such as through exclusion fencing, destruction of warrens and target "Pindone" baiting is however recommended as a standard protocol to control rabbit invasion. This should ideally be undertaken in a coordinated approach with surrounding rabbit affected habitat areas.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this newly listed key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion and establishment of exotic vines and scramblers

The proposal is of a class of development recognised as a threatening process due to the presence of exotic vines and scramblers within the site and the potential for these species to invade the adjoining Warriewood Wetlands. Therefore a weed control program is recommended to ensure there is adequate eradication, and control of invasive vines species.

Invasion of native plant communities by exotic perennial grasses

Turf and lawn is regularly placed in development areas, and where they adjoin native vegetation areas, these grasses may invade and take over the ground layer. There are some exotic perennial grasses within the site but they do not penetrate the natural bushland because of the allelopathic effects of the Casuarina needles.

Where there is lawn proposed, it should be managed regularly, and treated as a weed where it does extend beyond the development area into native bushland.

Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

As the development site boundary is located adjacent to bushland and wetlands, the use of locally occurring native species for landscaping is important, or the use of species that have limited capacity to spread and invade bushland areas. The proposal has a high potential for increasing escaped garden plants into the bushland areas without proper control mechanisms.

Predation by feral cat (Felis catus)

The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic cat ownership and as such the action proposed may increase the impact of this threatening process.

Removal of dead wood and dead trees

The proposal will require the removal of deadwood and dead trees and as such is of a class of development recognised as a threatening process. A number of dead trees are notably

present within the northern extent of the subject site. The cause of senescence and dieback of these trees has not been determined. These trees have not been found to contain any hollows.

Threatened fauna species with potential habitat within the subject site and likely dependent on dead wood or dead trees include Bush Stone-curlew, Varied Sittella, Green and Golden Bell Frog, Scarlet Robin and Dusky Woodswallow. These species have not been recorded to date within the study area. Given the low quality habitat associated with deadwood and dead trees present within the development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.